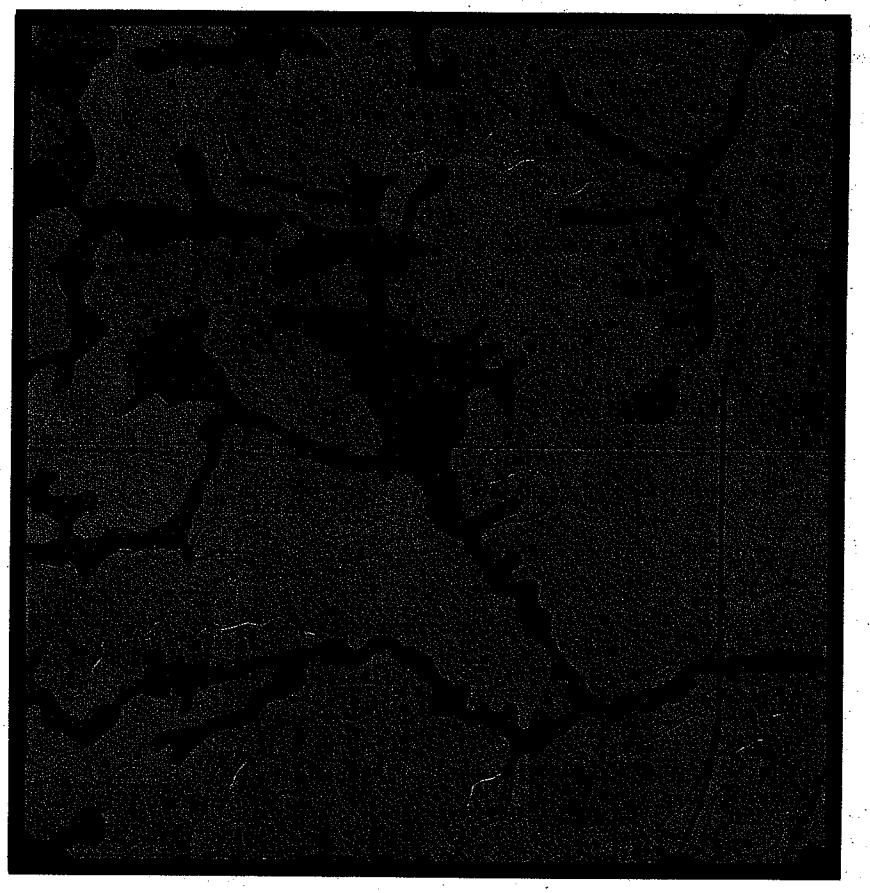
Extension Bulletin E-1262 FILE: 32.14 Reprinted April 1982

Soil Management Units and Land Use Planning



MICHIGAN STATE UNIVERSITY
COOPERATIVE EXTENSION SERVICE

Soil Management Units and Land Use Planning

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Land use and land use planning are of increasing concern because of limited soil resources and their many possible uses. When planning the use of any area, its soil is an important consideration. A soil's suitability for a particular use often depends on characteristics of its profile to a depth of 3 to 5 feet. Also, an area used for buildings, parking lots, airports or highways is not easily returned to crop production.

This report will help you plan land use by relating soil maps, soil management groups and soil management units to the limitations of land use for various uses.

Soil characteristics result from interactions of plants and animals, climate, slope and water table on parent material. Knowledge of the environment in which the soil formed and the parent materials from which it developed enables soil scientists to predict how the soil will respond to various uses and management.

SOIL MAPS

Soil surveys of various kinds have been made in Michigan since 1901 (6). Soil maps made after 1940 are helpful for planning most land uses. Those made between 1925 and 1939 (particularly those after 1930) can be made useful for general farm planning and/or less detailed planning by updating the mapping unit legend. Most soil maps made before 1925 are too general for land use planning.

Land type maps (reconnaissance soil surveys) made between 1935 and 1951 in Northern Michigan are suitable for general land use planning if the mapping unit legend is updated. All soil survey information must be supplemented by on-site investigations for most surburban and engineering uses.

SOIL MANAGEMENT GROUPS

Mapping unit names in soil surveys identify the predominant soil series and their subdivisions. Soil series are similar in thickness, arrangement of horizons and other physical, chemical and biological properties. Each series is named for a town or geographical feature located near the place where the soil series was first recognized.

Soil series may be grouped according to dominant texture of the profile and natural drainage conditions. These groups are called soil management groups and are designed systematically by numbers and letters. This makes it easier to remember their significant properties—which affect various land uses.

Approximately 433 soil series have been mapped in Michigan. The properties of these soils are not indicated by the name, but the numbers and letters of the soil management group system help one recall the significant properties of the soil.

PROFILE TEXTURE

Texture refers to the proportion of sand, silt and clay present in a soil sample. It does not include the organic matter or gravel and coarser particles. Sand particles are from 0.05 to 2.0 mm in diameter and feel harsh and gritty. Silt particles range from 0.002 to 0.05 mm in diameter and feel soft and flourlike. Clay particles are less than 0.002 mm in diameter and feel greasy when moist. See Fig. 1 for interrelationships of common soil textural classes.

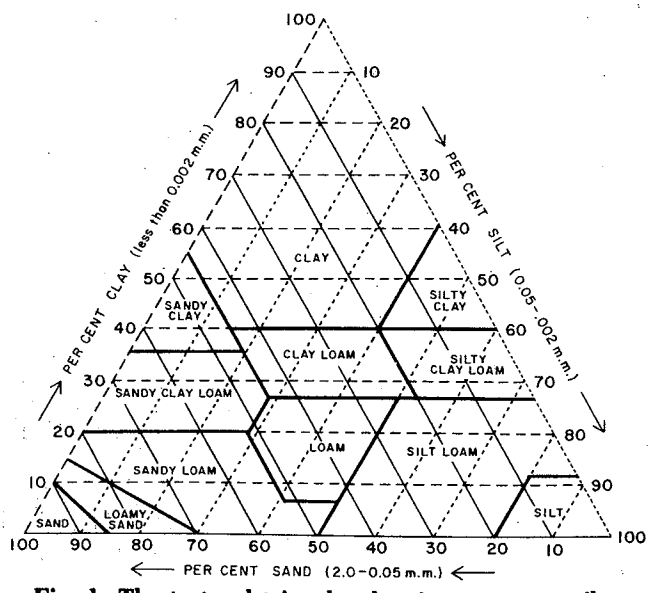

Fig. 1. The textural triangle, showing common soil textural classes.

Soils can be separated into mineral and organic soils on the basis of parent material. Mineral soils are given a number based on the dominant profile texture as follows: O—fine clay, more than 60% clay; 1—clay, 40 to 60% clay; 1.5—clay loam and silty clay loam; 2.5—loam and silt loam; 3—sandy loam; 4—loamy sand; and 5—sand.

Because of significant differences in available water-holding capacities, the sands are further subdivided based on the subsoil development and iron accumulation of the B horizon: 5.0 for sands with strong subsoil development, large iron accumulation; 5.3 for sands with medium subsoil development; and 5.7 for sands with weak or no subsoil development, little or no iron accumulation.

The dominant profile texture is the texture of which most of the upper five feet of soil is composed. For example, a soil with the following horizons: Ap—0 to 7 inches, loamy sand; A12—7 to 14 inches, loamy sand; C1g—14 to 43 inches, sand; and C2g—43 to 61 inches, sand; has a dominant profile texture of sand. The soil has 47 inches of sand and only 14 inches of loamy sand.

Soils developed from uniform parent materials are represented by one number (left column, Table 1). Soils developed from two-storied parent materials or with contrasting textures in their profiles are represented by fractions (left column, Table 2). The numerator represents the texture of the upper story and the denominator the lower story. For example, 3/1 represents soils with 14-40 inches of sandy loam over clay.

Soils which are very gravelly or stony throughout their profile are indicated by a capital G (Table 1). Alluvial or lowland soils having stratified materials and subject to flooding are preceded by a capital L. Soils which are less than 20 inches to bedrock are indicated by a capital R. Soils having 20 to 40 inches of soil material over bedrock are subdivided by characteristics of overlying materials as the numerator

Table 1—Interrelationships of soil management groups for soils developed from uniform parent material.

Dominant profile texture	Symbols	Natural drainage class: Well and moderately well drained a	Somewhat poorly drained b	Poorly and very poorly drained c
Fine clay, over 60% clay	0	0a	0b	0c
Clay, 40-60% clay	1	1a	1b	1c
Clay loam and silty clay loam	1.5	1.5a	1.5b	1.5c
Loam and silt loam	2.5	2.5a	2.5b	2.5c
Sandy loam	3	3a	3b	3c
Loamy sand	4	4a	4b	4c
Sand with strong subsoil development	5.0	5a	5b	5c
Sand with medium subsoil development	5.3	5.3a	5b	5c
Sand with weak or no subsoil development	5.7	5.7a	5b	5c
Gravelly or stony loamy sand to loam	G	Ga	Gbc	Gbc
Bedrock, less than 20 inches	R	Ra	Rbc	Rbc
Alluvial or lowland soils	L			
loamy	L-2	L-2a	L-2c	L-2c
sandy	L-4	L-4a	L-4c	L-4c

Table 2—Interrelationships of soil management groups for mineral soils with contrasting textures in their profile.

Dominant profile texture	Symbols	Natural drainage class: Well and moderately well drained a	Somewhat poorly drained b	Poorly and very poorly drained c
Clay, 20-40 inches, over gravelly sand	1/5	1/5a	1/5b	1/5c
Sandy loam, 14-40 inches, over clay	3/1	3/1a	3/1b	3/1c
Sandy loam, 20-40 inches, over loam to clay loam	3/2	3/2a	3/2b	3/2c
Sandy loam, 20-40 inches, over gravelly sand	3/5	3/5a	3/5b	3/5c
Loamy sand, 14-40 inches, over clay	4/1	4/1a	4/1b	4/1c
Sand to loamy sand, 20-40 inches, over loam to clay loam	4/2	4/2a	4/2b	4/2c
Sand to loamy sand, 40-60 inches, over loam to clay	5/2	5/2a	5/2b	5c
Loam, 20-40 inches, over bedrock	2/R	2/Ra		
Sandy loam, 20-40 inches, over bedrock	3/R	3/Ra	3/Rbc	3/Rbc
Sand to loamy sand, 20-40 inches, over bedrock	4/R	4/Ra	4/Rbc	4/Rbc

of a fraction (Table 2): 2/R—loam over bedrock; 3/R—sandy loam over bedrock; and 4/R—loamy sand or sand over bedrock.

Organic soils are indicated by a capital M for muck or peat. Thin (16 to 51 inches) organic soils are subdivided by characteristics of underlying mineral materials (Table 3): M/1—muck over clay; M/3—muck over marl; and M/R—muck over bedrock. Thick (greater than 51 inches) organic soils are given only the symbol M.

NATURAL DRAINAGE

Lower case (small) letters are used to indicate natural drainage conditions: (a) well and moderately well-drained, (b) somewhat poorly drained (formerly called imperfectly drained) and (c) poorly and very poorly drained. Natural soil drainage is related to water table depth and the length of time during the year that the water table is in contact with part of the soil profile. The letters follow the numbers or capital letters of the dominant profile texture in the soil management group symbol. The interrelationships among soil management groups are shown in Tables 1, 2 and 3.

The somewhat poorly drained, poorly drained, and very poorly drained gravelly or stony soils, such as Nestoria and Diana, are combined into one soil management group, Gbc (Table 1). The drainage classes of the shallow and very shallow bedrock soils are similarly combined. The somewhat poorly and poorly drained alluvial soils are also combined, but drainage is indicated by c, for example L-2c (Table 1).

Well-drained soils have water tables below 40 inches and commonly below 60 inches. Moderately well-drained soils have water tables between 30 and 40 inches for a short time during spring. Somewhat poorly drained soils have water tables near the surface sometime during the year, usually in winter and spring. During summer these soils may have water tables below 60 inches. Poorly drained soils have water tables near the surface much of the year, but during the summer they may be lower in the profile.

Table 3—Interrelationships of soil management groups for organic soils.

Depth of organic materials	Underlying material	Very poorly drained (c)
Greater than 51 inches		Mc
16-51 inches	Clay	M/1c
16-51 inches	Sandy loam to clay loam	M/3c
16-51 inches	Loamy sand to sand	M/4c
16-51 inches	Marl (a)	M/mc
16-51 inches	Bedrock	M/Rc

(a) Unconsolidated calcium carbonate which forms in lakes.

During dry periods when the water table cannot be observed near the land surface, natural soil drainage can be identified by observing the color patterns of soil profiles. Well-drained Michigan soils have light colored surfaces to plow depth and bright reddish brown colored subsoils with no mottles above 40 inches, or if they developed under grasses rather than trees, they may have dark colored surfaces.

Moderately well-drained soils have light colored surfaces and bright reddish brown subsoils with gray and orange mottles below 30 inches. Somewhat poorly drained soils have moderately dark surfaces and reddish brown subsoils with gray, brown and orange mottles throughout. Poorly drained soils have dark surfaces and gray subsoils with orange, brown and yellow mottles throughout.

Other soil profile characteristics important to land use planning are indicated by adding a dash and a second lower case letter to the number for the dominant profile texture and lower case letter for natural drainage. A lower case a after a dash indicates soils with very strongly acid (pH less than 4.5) subsoils. A lower case c following a dash indicates calcareous or limy conditions within 10 inches of the surface. A lower case d indicates dense or compact subsoils. A lower case f indicates the presence of a fragipan which is a dense, brittle horizon. A lower case h indicates hardened or cemented subsoils (ortstein). A lower case s indicates stratification with fine sands and silts.

Thus, the Oa soil management group, such as Ontonagon (Table 4), represents well-drained soils containing more than 60% clay. The 4/2c-c soil management group includes soils, such as Essexville, developed from 20 to 40 inches of loamy sand over loam to silty clay loam under naturally poorly drained conditions. They are calcareous at or near the surface.

If a soil has two or more other important profile characteristics, two or more letters follow the dash. For example, the 2.5b-cs includes soils with a dominant profile texture of loam or silt loam that are somewhat poorly drained, calcareous within 10 inches of the surface, and stratified with fine sands and silts.

The Gbc soil management group represents gravelly or stony soils, such as Nestoria and Diana, developed under somewhat poorly drained or poorly drained conditions. The L-4c soil management group includes alluvial soils, such as Algansee and Glendora, developed from sand and loamy sand under somewhat poorly drained or poorly drained conditions on floodplains subject to seasonal overflow. The Mc soil management group represents deep organic soils, such as Carlisle, that are naturally very poorly drained.

Several soil series, such as Bellefontaine, have characteristics of two or more soil series. These are designated by two or more soil management group

(continued on page 8)

Table 4 — Soil management group designation for soil series in Michigan.

Soil series	Soil management group	Soil series	Soil management group	Soil series	Soil management group	Soil series	Soil management group
Abscota	L-4a	Brimley	2.5b-s	Dowagiac	3/5a	Griffin	L-2c & L-4c
Adolph	2.5c	Bronson	3a	Dresden	3/5a	Grindstone	2.5a-d
Adrian	M/4c	Brookston	2.5c	Dryburg	3/1a	Guelph	2.5a
Ahmeek	3a-af	Bruce	2.5c-s	Dryden	3a	Hartwick	5a
Alcona	3a-s	Brule	L-2c	Duel	4/Ra	Henrietta	3c
Algansee	L-4c	Bruleigh	4/2c	Dumbridge	2.5a	Hessel	Gbc
Alger	3a	Burt	Rbc	East Lake	5a	Hettinger	1.5c
Allendale	4/1b	Cadmus	3/2a	Eastport	5.3a	Hiawatha	5a
Allouez	Ga	Capac	2.5b	Echo	5a	Hibbing	1.5a
Alpena	Ga	Carbondale	Mc	Edmore	4c	Hillsdale	3a
Amasa	3/5a-a	Carlisle	Mc	Edwards	M/mc	Houghton	Mc
Angelica	2.5c	Casco	4a	Eel	L-2a	Hoytville	1c
Antico	3/5a	Cathro	M/3c	Eleva	2/Ra	Huntington	L-2a
Antrim	4a	Celina	2.5a	Elmdale	3a	Huron	1a
Arenac	5/2b	Ceresco	L-2c	Elo	2.5a-af	Ingalls	4/2b
Arkona	4/1b	Champion	3a-af	Elston	4a	Ingersoll	2.5b-s
Arkport	3a-s	Channahon	Ra	Emmert	Ga	Ionia	3/5a
Ashkum	1.5c	Channing	5b-h	Emmet	3a	Iosco	4/2b
Aubarque	2.5b-cd	Charity	1c-c	Ensign	Rbc	Iron River	3a-af
Aubbeenaubbee	3/2b	Charlevoix	3b	Ensley	3c	Isabella	2.5a
AuGres	5b	Chatham	3a	Epoufette	4c	Ishpeming	4/Ra
Aurelius	M/mc	Chelsea	5a	Essexville	4/2c-c	Ithaca	1.5b
AuTrain	5a-h	Cheneaux	4b	Evart	L-4c	Jeddo	1.5c
Avoca	4/2b	Chestonia	1.5b	Ewen	L-2a	Johnswood	Ga
Bach	2.5c-cs	Chippeny	M/Rc	Fabius	4b	Kalamazoo	3/5a
Badaxe	3/2b-d	Cohoctah	L-2c	Fairport	2/Ra	Kalkaska	5a
Baraga	Ga-f	Coldwater	3b	Fence	3a	Karlin	4a
Barker	1.5a	Coloma	5a	Fifield	3b	Kawbawgam	3/Rbc
Barry	3c	Colonville	L-2c-c	Filion	Gc-cd	Kawkawlin	1.5b
Belding	3/2b	Colwood	2.5c-s	Finch	5b-h	Kendallville	3/2a
Bellefontaine	3/5a & 4a	Conover	2.5b	Fox	3/5a	Kent	1a
Belleville	4/2c	Coral	3b	Froberg	1a	Keowns	3c-s
Bentley	4a	Corunna	3/2c	Fulton	1b	Kerston	L-Mc
Bergland	Oc	Coupee	3/5a	Gaastra	2.5b	Keweenaw	4a-a
Berrien	5/2a			Gagetown	2.5a-cs	Kibbie	2.5b-s
Berville	3/2a	Coventry	3/5a	Gay	3c	Kidder	2.5a
Bixby	3/5a	Covert	5a	Genesee	L-2a	Kilmanagh	2.5c
Bixler	4/2b-s	Crivitz	4a-a	Gilchrist	4a	Kingsville	5c
Blount	1.5b	Crosby	2.5b	Gilford	4c	Kinross	5c-a
Blue Lake	4a	Crosier	2.5b	Gladwin	4b	Kiva	4a
Bohemian	2.5a-s	Croswell	5a	Glendora	L-4c	Kokomo	2.5c
Bono	1c	Dawson	M/4c-a	Glynwood	1.5a	Lacota	3c
Boots	Mc	Deer Park	5.3a	Gogebic	3a-af	Lake Linden	1.5a
Bowers	1.5b	Deerton	4/Ra	Goodman	2.5a	Lamson	3c-s
Boyer	4a	Deford	4c	Gorham	L-2c	Landes	L-2a
Brady	3b	Del Rey	1.5b	Gormer	L-2c	Lapeer	3a
Breckenridge	3/2c	Detour	Gbc	Granby	5c	Latty	1c
Brems	5b	Diana	Gbc	Graycalm	5a	Leelanau	4a
Brevort	4/2c	Dighton	2.5a	Grayling	5.7a	Lenawee	1.5c
Bridgman	5.3a	Dixboro	3b-s	Greenwood	Mc-a	Leoni	Ga

Table 4 — Soil management group designation for soil series in Michigan.

Soil series	Soil management group
Linwood	M/3c
Locke	3b
Londo	2.5b
London	2.5b
Longlois	2.5a
Longrie	3/Ra
Loxley	Mc-a
Lupton	Mc
Mackinac	2.5b
Macomb	3/2b
Mancelona	4a
Manistee	4/1a
Markey	M/4c
Marlette	2.5a
Martinsville	2.5a
Martisco	M/mc
Matherton	3/5b
Maumee	5c
McBride	3a-f
McGregor	3/5b-c
Mecosta	L-4a
Melita	5/2a
Menominee	4/2a
Metamora	3/2b
Metea	4/2a
Miami	2.5a
Michigamee	3/Ra & Ra
Millsdale	2/Rbc
Milton	2/Ra
Minoa	3b-s
Mitiwanga	3/Rbc
Monico	3b-a
Monitor	2.5b
Montcalm	4a
Moran	2/Ra
Morley	1.5a
Morocco	5b
Moye	4b
Munising	3a-af
Munuscong	3/1c
Mussey	4c
Nahma	3/Rbc
Napoleon	Mc-a
Nappanee	1b
Negaunee	3/Ra
Nester	1.5a
Nestoria	Gbc
Newaygo	3/5a
Newton	5c
Nottawa	4a
Nunica	1.5a
Oakville	5.3a
Ockley	2.5a
Ocqueoc	4/2a
Ogden	M/1c
Ogemaw	5b-h
Okee	4/2a
Olentangy	M/3c
Omega	5.7a
Omena	3a
Onamia	3/5a
Onaway	2.5a
Onota	3/Ra
Ontonagon	Oa
Ormas	4a
Oshtemo	3a
Otisco	4b
Ottawa	5/2a
Ottokee	4a
Owosso	3/2a
Padus	3a-a
Palms	M/3c
Palo	3/5b
Parkhill	2.5c
Parma	3/Ra
Paulding	Oc
Pella	2.5c-s
Pence	4a-a
Pequaming	4b
Perrin	4a
Perrinton	1.5a
Pert	1b
Perth	1b
Peshekee	Ra
Pewamo	1.5c
Pickford	1c
Pinconning	4/1c
Pinnebog	Mc
Pipestone	5b
Plainfield	5.3a
Pleine	3c
Porcupine	4a
Posen	3a
Poseyville	3/2b
Poy	1/5c
Randolph	2/Rbc
Randville	4a-a
Rapson	4/2b-s
Rensselaer	2.5c
Richter	3b-s
Riddles	2.5a
Rifle	Mc
Rimer	4/1b
Riverdale	4b
Rodman	Ga
Rollin	M/mc
Ronald	3/5c
Rondeau	M/mc
Roscommon	5c
Roselawn	5.3a & 4a
Roselms	Ob
Rousseau	4a
Rubicon	5.3a
Rudyard	Ob
Ruse	Rbc
Saganing	4c
Sanilac	2.5b-cs
Saranac	L-2c
Satago	3/Rbc
Sauble	5.3a
Saugatuck	5b-h
Saverine	3/2b
Saylesville	1.5a
Schoolcraft	3/5a
Sebewa	3/5c
Selfridge	4/2b
Selkirk	1b
Seward	4/1a
Shebeon	2.5b-d
Shelldrake	5.3a
Shinrock	1.5a
Shoals	L-2c
Sickles	4/1c
Sigma	4b
Sims	1.5c
Sisson	2.5a-s
Skanee	3b-af
Sleeth	2.5b
Sloan	L-2c
Spalding	Mc-a
Sparta	5a
Spinks	4a
St. Clair	1a
St. Ignace	Ra
Stambaugh	3/5a-a
Steuben	3a-af
Strawn	2.5a
Strongs	5a
Suamico	M/1c
Summerville	Ra
Sumner	4a
Sundell	3/Rbc
Sunfield	3/5a
Superior	1a
Tacoosh	M/3c
Tahquamenon	Mc-a
Tappan	2.5c-c
Tawas	M/4c
Teasdale	3b
Tedrow	5b
Thackery	2.5a
Thetford	4b
Thomas	2.5c-c
Thomastown	4b
Tobico	5c-c
Toledo	1c
Tonkey	3c-s
Tracy	3a-a
Traunik	5b
Traverse	3b
Trenary	3a
Trout Lake	5b-h
Tula	3b
Tuscola	2.5a-s
Tustin	4/1a
Twining	1.5b
Tyre	4/Rbc
Ubly	3/2a
Vestaburg	5c
Vilas	5.3a
Volinia	3/5a
Wainola	4b
Waiska	Ga
Wakefield	2.5a-af
Wallace	5a-h
Wallkill	L-2c
Warners	M/mc
Warsaw	3/5a
Wasepi	4b
Washtenaw	L-2c
Watton	1.5a
Wauseon	3/1c
Wautoma	3/1c
Wea	2.5a
Weare	5a
Westland	2.5c
Wexford	5a
Whalan	3/Ra
Wheatley	5c
Whitaker	2.5b
Willette	M/1c
Winegars	4b
Winneshiek	2/Ra
Winterfield	L-4c
Wisner	2.5c-c
Witbeck	3c
Wixom	4/2b
Yalmer	4a-af
Ypsi	3/1b

Additional Soil Series in Michigan

Series	Management Group
Arnheim	L-2c
Assinins	3b
Bonduel	2/Rbc
Bowstring	L-Mc
Grattan	5.3a
Hatmaker	2.5b
Hodenpyl	3/5a
Kallio	3/2a-f
Lunds	4b
Menquah	L-2c
Minocqua	4c
Moquah	L-2c
Mosomo	5a
Mudsock	2.5c
Oconto	4a
Pelkie	5.7a
Remus	3a
Scalley	3/5a
Sayner	5a-a
Shawano	5.7a
Sturgeon	L-2b
Tekenink	3a
Vermilac	1.5b
Wolcott	2.5c
Woodbeck	1/5a
Ziegenfuss	1.5c

symbols (Table 4) as included in mapping units on published soil maps.

SOIL MANAGEMENT UNITS

For many land uses, soil management groups must be further subdivided. For example, the well-drained a groups need to be subdivided into slope classes. Slope represents the gradient or steepness of the soil surface and is expressed as a percentage. Percent slope is equal to the feet rise or fall of the land surface for each 100 feet of horizontal distance. Slope classes have been arbitrarily established and designated by capital letters. Those commonly found in recent (since 1940) Michigan soil surveys are:

A—0 to 2% slope,
B—2 to 6% slope,
C—6 to 12% slope,
D—12 to 18% slope,
E—18 to 25% slope,
F—greater than 25% slope.

Somewhat poorly drained soils rarely have slopes greater than 6%, and poorly drained soils usually have slopes less than 2%. The soil management group symbol plus the slope class symbol make up a soil management unit symbol. For example, 1.5aC represents soil profiles of clay loam textures that are well drained and have 6 to 12% slopes.

For some uses, such as cropland, the amount of accelerated soil erosion is important. The following four classes of erosion have been defined to describe the degree of water erosion which occurred previous to mapping: 1—slight, 2—moderate, 3—severe, and 4—very severe (7). The erosion class symbol is added to the soil management unit symbol only if the class is severe or very severe. For example, 2.5aE3 represents soil profiles of loam textures that are well drained, have 18 to 25% slopes and are severely eroded. Soil management units combine soils with similar profiles, management requirements and responses to like management practices.

Soil management groups have been used for both agricultural and nonagricultural land use planning. Fertilizer recommendations are based on both soil test results and soil management groups (2). Recommendations for no-tillage systems of corn production are based on soil management groups (4). Soil management groups are also being used in the selection of coniferous planting stock (1) as well as the design of artificial drainage systems. Yield potentials and soil management groups are the basis for productivity groupings which the Michigan State Tax Commission uses for equitable farmland evaluation (3).

Soil management units have been used to determine suitability of soils for municipal wastewater disposal (5). Engineering properties have been summarized by soil management groups (8). Some of Michigan's 14 regional planning commissions are using soil management units and degree of limitation similar to the information in Table 5 in making land use planning decisions.

LIMITATIONS FOR SIX LAND USES

Degrees of limitation of soil management units for six land uses are given in Table 5. The six uses are: residential development, with and without public sewer; roads and streets; intensive play areas; cropland; and woodland. The degree of limitation refers to the intensity of problems related to the soil which will affect use and management of the soil. It is based on the soil's natural condition and is not for areas altered by cut-and-fill operations. The three degrees of limitation are: slight—few limitations or limitations that are easily overcome; moderate—limitations that can be overcome with careful design and good management; severe—limitations severe enough to make use questionable.

Limitations for residential development with public sewer are based on the soil properties which affect the foundation and basement. Limitations for residential development without public sewers are based on the soil properties which affect the septic tank disposal field and the foundation and basement of the house.

USING WITH SOIL MAPS

Each area on a soil map is represented by a map symbol identified in the mapping unit legend. The symbol indicates the soil series, texture of the plow layer and slope. For some symbols, slope is omitted. Usually slope class is then A, 0 to 2%, but sometimes the symbol represents land types with considerable range in slope. If uncertain, consult the soil survey report.

To determine the soil management group for each soil series, see Table 4. The addition of slope, from the mapping unit legend, to the soil management group produces the soil management unit. Using the soil management unit and Table 5, limitations for various uses can be determined.

The following suggestions may help you use a soil map:

1. Place the soil management group or unit designations on the soil map in red (Fig. 2).

2. Develop a limitation map or single factor map for a single land use by coding each degree of limitation the same color. Color soils with slight limitations green, those with moderate limitations yellow, and those with severe limitations red. Where two degrees of limitation apply, hatching with both colors can be used.

Table 5—Degree of limitation of soil management units for various uses

Soil management unit			Degree of limitation for various uses (a)					
			Residential development					
Soil management group	Slope		Without public sewer	With public sewer (b)	Roads and streets	Intensive play areas	Cropland	Woodland
	Class	%						
Group 0 Fine clay soils (over 60% of clay)								
Oa	A,B	0-6	Sev	Sev	Sev	Sev	Mod	Sli-Mod
	C	6-12	Sev	Sev	Sev	Sev	Mod	Sli-Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli-Mod
Ob	A,B	0-6	Sev	Sev	Sev	Sev	Mod	Sev
Oc	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
Group 1 Clay soils (40-60% clay)								
1a	A,B	0-6	Sev	Sev	Sev	Sev	Sli	Sli-Mod
	C	6-12	Sev	Sev	Sev	Sev	Mod	Sli-Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli-Mod
1b	A,B	0-6	Sev	Sev	Sev	Sev	Sli	Sli-Mod
1c	A	0-2	Sev	Sev	Sev	Sev	Sli	Sev
Group 1.5 Clay loam and silty clay loam soils								
1.5a	A,B	0-6	Sev	Mod	Mod	Mod	Sli	Sli-Mod
	C	6-12	Sev	Mod	Mod	Sev	Mod	Sli-Mod
	D	12-18	Sev	Sev	Mod	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Mod	Sev	Sev	Sli-Mod
1.5b	A,B	0-6	Sev	Sev	Sev	Mod-Sev	Sli	Sli-Mod
1.5c	A	0-2	Sev	Sev	Sev	Sev	Sli	Sli-Mod
Group 2.5 Loam and silt loam soils								
2.5a	A,B	0-6	Sev	Sli	Mod	Mod	Sli	Sli
	C	6-12	Sev	Mod	Mod	Sev	Mod	Sli
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli
2.5b	A	0-4	Sev	Sev	Sev	Sev	Sli	Sli-Mod
2.5c	A	0-2	Sev	Sev	Sev	Sev	Sli	Sli-Mod
Group 3/1 Sandy loam (14-40 inches thick) over clay soils								
3/1a	A,B	0-6	Sev	Sev	Sev	Mod	Sli	Sli
	C	6-12	Sev	Sev	Sev	Sev	Mod	Sli
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli
3/1b	A	0-4	Sev	Sev	Sev	Mod	Sli	Sli-Mod
3/1c	A	0-2	Sev	Sev	Sev	Sev	Sli	Sli-Mod
Group 3/2 Sandy loam (20-40 inches thick) over clay loam to loam soils								
3/2a	A,B	0-6	Sev	Sli	Mod	Mod	Sli	Sli
	C	6-12	Sev	Mod	Mod	Sev	Mod	Sli
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli
3/2b	A	0-4	Sev	Mod	Sev	Sev	Sli	Sli-Mod
3/2c	A	0-2	Sev	Sev	Sev	Sev	Sli	Mod
Group 3 Sandy loam soils								
3a	A,B	0-6	Sli	Sli	Mod	Sli	Sli	Sli-Mod
	C	6-12	Mod	Mod	Mod	Sev	Mod	Sli-Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli-Mod
3b	A	0-4	Sev	Mod	Sev	Sev	Sli	Sli-Mod
3c	A	0-2	Sev	Sev	Sev	Sev	Sli	Mod

(a) Sli-slight; Mod-moderate; Sev-severe

(b) Limitations for residential development with public sewer also apply to foundations for low buildings.

(c) Possible contamination of groundwater supply.

Table 5—Degree of limitation of soil management units for various uses (continued)

Soil management unit			Degree of limitation for various uses (a)					
			Residential development					
Soil management group	Slope Class	Slope %	Without public sewer	With public sewer (b)	Roads and streets	Intensive play areas	Cropland	Woodland
Group 3/5 Sandy loam (20-40 inches thick) over sand and gravel								
3/5a	A,B	0-6	Sli (c)	Sli	Sli	Mod	Sli	Sli
	C	6-12	Mod (c)	Mod	Mod	Sev	Mod	Sli
	D	12-18	Sev (c)	Sev	Sev	Sev	Sev	Sli
	E,F	18+	Sev (c)	Sev	Sev	Sev	Sev	Sli
3/5b	A	0-4	Sev (c)	Mod	Sev	Mod	Sli	Sli-Mod
3/5c	A	0-2	Sev (c)	Sev	Sev	Sev	Sli	Sli-Mod
Group 4/1 Loamy sand (14-40 inches thick) over clay soils								
4/1a	A,B	0-6	Sev	Sev	Sli	Sev	Mod	Sli-Mod
	C	6-12	Sev	Sev	Mod	Sev	Mod	Sli-Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli-Mod
4/1b	A,B	0-6	Sev	Sev	Sev	Sev	Mod	Mod
4/1c	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
Group 4/2 Loamy sand (20-40 inches thick) over loam soils								
4/2a	A,B	0-6	Sev	Sli	Mod	Mod	Mod	Sli-Mod
	C	6-12	Sev	Mod	Mod	Sev	Mod	Sli-Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli-Mod
4/2b	A	0-4	Sev	Sev	Sev	Mod-Sev	Mod	Mod
4/2c	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
Group 4 Loamy sand soils								
4a	A,B	0-6	Sli (c)	Sli	Sli	Mod	Mod	Sli-Mod
	C	6-12	Mod (c)	Mod	Mod	Sev	Mod	Sli-Mod
	D	12-18	Sev (c)	Sev	Sli	Sev	Sev	Sli-Mod
	E,F	18+	Sev (c)	Sev	Sli	Sev	Sev	Sli-Mod
4b	A	0-4	Sev (c)	Mod	Mod	Mod-Sev	Mod	Mod
4c	A	0-2	Sev (c)	Sev	Sev	Sev	Mod	Mod
Group 5/2 Sand to loamy sand (40-60 inches thick) over loam to clay soils								
5/2a	A,B	0-6	Sli-Mod	Sli-Mod	Sli	Sev	Mod	Sli-Mod
	C	6-12	Mod	Mod	Sli	Sev	Sev	Sli-Mod
	D	12-18	Sev	Sev	Sli	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Sli	Sev	Sev	Sli-Mod
5/2b	A	0-4	Sev	Sev	Mod	Sev	Mod	Mod
5c	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
Group 5 Sand soils								
5a,5.3a,5.7a	A,B	0-6	Sli(c)	Sli	Sli	Sev	Sev	Sli-Mod
	C	6-12	Mod (c)	Mod	Mod	Sev	Sev	Sli-Mod
	D	12-18	Sev (c)	Sev	Sev	Sev	Sev	Sli-Mod
	E,F	18+	Sev (c)	Sev	Sev	Sev	Sev	Sli-Mod
5b	A	0-4	Sev (c)	Mod	Mod	Sev	Mod	Mod
5c	A	0-2	Sev (c)	Sev	Sev	Sev	Mod	Sev
Group G Gravelly or stony soils								
Ga	A,B	0-6	Sli (c)	Sli	Sli	Sev	Sev	Sli-Mod
	C	6-12	Mod (c)	Mod	Mod	Sev	Sev	Sli-Mod
	D	12-18	Sev (c)	Sev	Sev	Sev	Sev	Mod
	E,F	18+	Sev (c)	Sev	Sev	Sev	Sev	Sli-Mod
Gbc	A	0-4	Sev (c)	Sev	Sev	Sev	Sev	Sev

(a) Sli-slight; Mod-moderate; Sev-severe

(b) Limitations for residential development with public sewer also apply to foundations for low buildings.

(c) Possible contamination of groundwater supply.

Table 5—Degree of limitation of soil management units for various uses (continued)

Soil management unit			Degree of limitation for various uses (a)					
			Residential development					
Soil management group	Slope Class	Slope %	Without public sewer	With public sewer (b)	Roads and streets	Intensive play areas	Cropland	Woodland
Group L Alluvial (lowland) soils								
L-2a	A	0-2	Sev	Sev	Sev	Sev	Mod	Sli-Mod
L-2c	A	0-2	Sev	Sev	Sev	Sev	Mod-Sev	Sli-Mod
L-4a	A	0-2	Sev	Sev	Sev	Sev	Mod-Sev	Mod
L-4c	A	0-2	Sev	Sev	Sev	Sev	Mod-Sev	Sev
L-Mc	A	0-2	Sev	Sev	Sev	Sev	Mod-Sev	Sev
Group M Organic soils (mucks and peats)								
Mc	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
M/1c	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
M/3c	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
M/4c	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
M/mc	A	0-2	Sev	Sev	Sev	Sev	Mod	Sev
M/Rc	A	0-2	Sev	Sev	Sev	Sev	Sev	Sev
Group R Bedrock soils								
Ra	A,B	0-6	Sev	Sev	Sev	Sev	Sev	Mod
	C	6-12	Sev	Sev	Sev	Sev	Sev	Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Mod
Rbc	A	0-4	Sev	Sev	Sev	Sev	Sev	Sev
Loam, 20-40 inches, over bedrock								
2/Ra	A,B	0-6	Sev	Sev	Mod	Mod	Mod	Sli-Mod
	C	6-12	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli-Mod
2/Rbc	A	0-4	Sev	Sev	Sev	Sev	Sev	Sli-Mod
Sandy loam, 20-40 inches, over bedrock								
3/Ra	A,B	0-6	Sev	Sev	Mod	Mod	Mod	Sli-Mod
	C	6-12	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Sli-Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Sli-Mod
3/Rbc	A	0-4	Sev	Sev	Sev	Sev	Sev	Sli-Mod
Sand to loamy sand, 20-40 inches, over bedrock								
4/Ra	A,B	0-6	Sev	Mod	Mod	Sev	Sev	Mod
	C	6-12	Sev	Mod	Mod	Sev	Sev	Mod
	D	12-18	Sev	Sev	Sev	Sev	Sev	Mod
	E,F	18+	Sev	Sev	Sev	Sev	Sev	Mod
4/Rbc	A	0-4	Sev	Sev	Sev	Sev	Sev	Mod

(a) Sli-slight; Mod-moderate; Sev-Severe.

(b) Limitations for residential development with public sewer also apply to foundations for low buildings.

(c) Possible contamination of ground water supply.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Gordon E. Guyer, Director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824.

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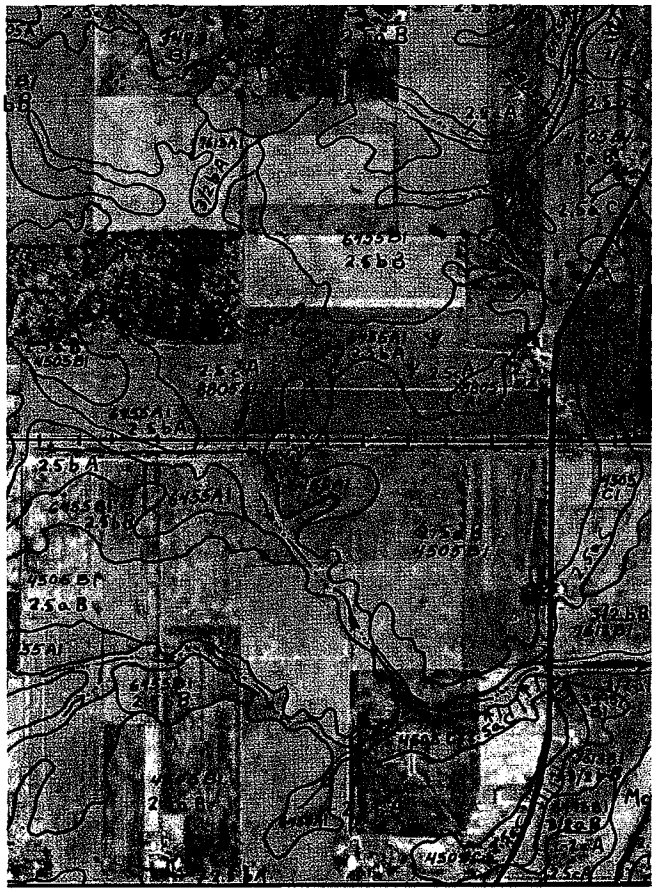

Fig. 2. Soil map of section 1, Sunfield Township, Eaton County, with soil management unit designations in red added to each map unit delineation.

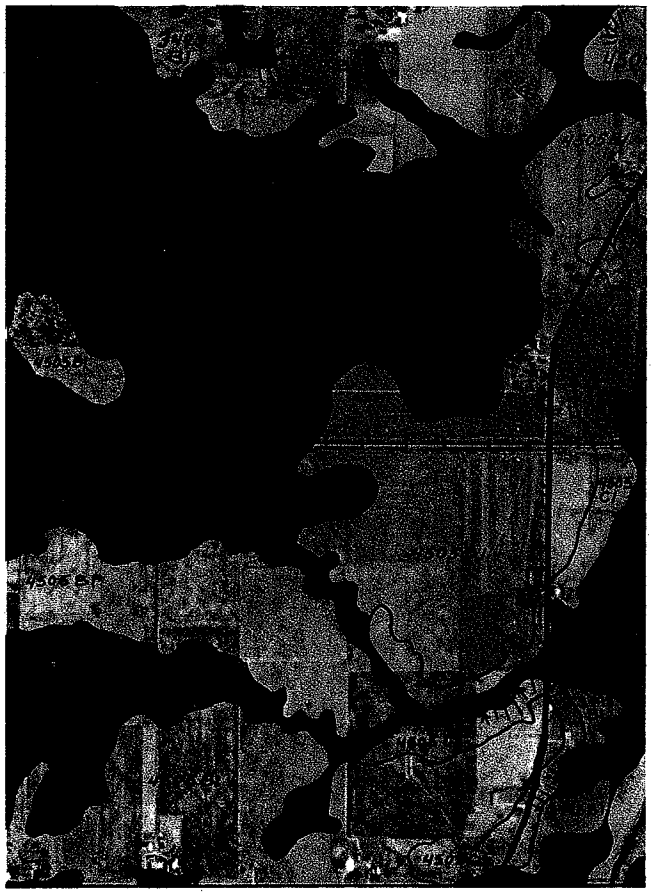

Fig. 3. Map showing degrees of limitation for residential development without public sewer in section 1, Sunfield Township, Eaton County. (Yellow—moderate limitations, red—severe limitations.)

The map in Fig. 3 shows the degrees of limitation for residential development without public sewer for the area in Fig. 2. This area has predominantly moderate (yellow) or severe (red) limitations for residential development without public sewer. Separate maps must be prepared for each land use and assumed condition of use.

The kind of map you choose will depend on the area and your interests. Some soil management units have no land uses with slight limitations and some have the same limitations for several land uses. Suggestion 1 (p. 8) may be most useful for smaller areas such as townships or relatively homogenous soil areas.

Soil maps, soil management units, and other pertinent information should help land use planners make the best decision based on the soil resources resulting in wise use of our soil resources for the welfare of all society.

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